shags, and waders. Work is progressing on the ecology of extinct species, and the assemblages in the avifauna, such as guild structure. Several species that are still common elsewhere, such as the Tui, used to be abundant in Canterbury. Most of the species in some guilds, such as the terrestrial herbivores, are either locally or globally extinct.

Chemical tracers of former mainland seabird breeding colonies

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Seabird breeding brings large quantities of nutrients ashore. Palaeontological methods have shown widespread pre-human seabird breeding on the New Zealand mainland, implying that prehuman New Zealand was less oligotrophic than today. However, it is often hard to infer a species' absence and to estimate colony extent. Further, preservation of material is limited in humid, low pH environments. Because soils are often old, we looked for soil indicators of former seabird breeding. We used predator deposits to identify two former breeding sites on calcareous soils in North Canterbury, and a control in Nelson. Maori tradition was used to identify an acidic site on Banks Peninsula, to see if results agreed with the calcareous soils. High total P, total N, total Cd, and $\delta^{15}N$; and low C:N and Cd:P ratios were found at former breeding sites on calcareous soils, but results from the acidic site showed likely confusion with agricultural inputs. Total Cd showed no potential for confusion with agricultural inputs, but is only applicable to calcareous soils. We are presently investigating $\delta^{13}C$ in deeper soil, where soil organic matter is older. The sole depth profile examined so far shows increasing $\delta^{13}C$ with depth, consistent with former seabird breeding.

Breeding of South Island Pied Oystercatchers (*Haematopus ostralegus finschi*) on farmland in mid Canterbury, New Zealand

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Breeding of South Island Pied Oystercatchers (*Haematopus ostralegus finschi*) on farmland in mid-Canterbury was studied during 1987 to 1996. Birds returned to breeding territories from early June, with females arriving about six days earlier than males. Laying dates extended from early August to mid November and were similar in all years. Most first clutches were laid from late August to mid September and up to two replacement clutches were laid. Clutch size averaged 2.26 (range 1 to 3 eggs) and declined through the breeding season, but was consistent from year to year. First clutches were larger than replacement clutches. About half the eggs

hatched and 59% of these chicks survived to fledge. Both hatching and fledging rates declined through the season. About half the pairs which laid in any year failed to rear a fledgling. Hatching success was greater in cultivated than pasture sites, but fledging success was similar at both sites. Trampling by stock, farming activities, and unknown causes were the main causes of egg loss.

Skylarks on the Canterbury Plain - biological indicators?

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The Skylark (*Alauda arvensis*) is one of fifteen species of farmland bird of which populations have declined markedly in Western Europe over the last 25 years. In the UK seven species have declined by more than 50% including the Skylark (58%). The Skylark was introduced to New Zealand by the Acclimatisation Societies in the 1860s and its populations appear to flourish. Work at Lincoln University, in collaboration with the Royal Society for the Protection of Birds (RSPB), UK, is determining Skylark winter and breeding densities and analysing the ecological factors influencing these. Multivariate and time-lapse video analyses have identified key paddock variables and nest predators, respectively. Winter variables significantly influencing Skylark abundance are field size, vegetation height, and boundary height. Nest predation rates are up to 90%. On typical farmland habitats in the Canterbury Plain there are 0.25 to 1 breeding pairs per hectare. This contrasts with 0.1 to 0.25 breeding pairs per hectare in lowland Britain. Key summer variables determining territory size are being identified currently.

The feeding ecology of Kereru and Bellbird in a modified forest remnant, South Canterbury, New Zealand

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Exotic plant invasion threatens native plant populations, particularly in isolated forest remnants close to sources of exotic plant propagules. Ironically, exotic plants in forest remnants may provide additional food sources that allow the persistence of ecologically important species such as Kereru (*Hemiphaga novaeseelandiae*) and Bellbird (*Anthornis melanura*). This study investigated the use of exotic and native plant food sources by Kereru and Bellbird from February to June 1998 in a modified forest remnant in south Canterbury. The plants used by Kereru and Bellbird varied seasonally and reflected changes in plant phenology. For both species, the amount of fruit taken declined from autumn to winter, paralleling a decline in fruit availability.

Although exotic plants comprised only 4.3% of total basal area in the remnant, they comprised 18.4% and 12.6% of feeding observations for Kereru and Bellbird respectively. Exotic plants were fed on most extensively by Kereru during February